of course, whether in embryo or adult, represents the terminal point of the human body.

Fig. 8 perhaps will elucidate this more clearly than a description. The third and fourth sacral, as indicated in the figure, are distributed in their midventral portion to the rudiments of the genitalia surrounding the cloaca.

This distribution presumably holds true when the segments are projected on the rounded end of the adult body. In the two cases which I have reported, the fact that most of the territory involved (in Case I. by zoster, in Case II. by an area of hyperæsthesia) was in a position which in the customary diagrams is concealed, has led me to make a figure (Fig. 10) which shows the nether pole of the body with the legs somewhat in the position which they occupied in the early embryo. In the diagrams, such as are shown in Fig. 9, the upright position, causing, as it does, a deep gluteal fold, with a hidden perineum and scrotum, makes, even in Starr's excellent scheme, the zonal distribution for these lower sacral areas somewhat obscure.

I cannot, of course, pretend to any great accuracy in the outline of these areas, believing only that the figure makes the cutaneous strips of these lower segments more intelligible than do the older diagrams, and also that for purposes of clinical utility a margin of error is preferable to a certainty of confusion. I have taken, as the average form, the fourth sacral as supplying the perineum and lower part of the scrotum, the third sacral the upper part of the scrotum and penis, or corresponding organs in the female, and beginning to extend slightly down the back of the leg. It is not until we reach the second sacral, which has a leg distribution in its entirety, that we find any great degree of distortion to have resulted from the outgrowing extremities.*

ON THE LATE EFFECTS OF TYPHOID FEVER ON THE HEART AND VESSELS.

A CLINICAL STUDY.

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The series of observations here recorded is part of a study of the cardiac and vascular complications and sequels of the cases of typhoid fever treated in the last fourteen years in the clinic of Professor Osler, at the Johns Hopkins Hospital. Though not yet as complete as might be desired, the material already gathered seemed to me to be sufficient to justify an analysis of the results so far obtained.[1]

* * *

The infrequency of endocarditis as a complication of typhoid fever is generally recognized. Only 11 cases were noted among the 2000 Munich necropsies, while but 3 have been observed in nearly 100 necropsies at the Johns Hopkins Hospital.

The grave myocardial changes which may occur during the disease are well known, thanks to the studies of a large number of observers, from Laennec,[2] Louis,[3] and Stokes,[4] whose observations relate only to the gross appearances, down to the more minute histological investigations of Stein,[5] Zenker,[6] Hayem,[7] Déjerine,[8] Romberg,[9] Landouzy and Siredey,[10] Renaut,[11] Mollard and Regaud,[12] Giacomelli,[13] and many others. The extent of their clinical significance and their relation to the cardio-vascular manifestations of typhoid fever are still, however, questions of dispute. That the cardiac lesions as such may account for sudden collapse and death is scarcely to be doubted, but the clinical discrimination between the collapse due to disease of the heart muscle and that in which the condition is rather one of vaso-motor paralysis is often a difficult and uncertain matter. The interesting studies of Pässler and Rolly[14] would tend to support the idea that the latter mechanism may account for more instances of collapse in acute disease than has generally been supposed.

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[1] Read before the New York Academy of Medicine, October 20, 1903.

[2] Traité de l'auscultation, etc., Paris, 1819, 8°, vol. ii. pp. 286 et seq.

[3] Anatomical, Pathological, and Therapeutic Researches upon the Disease known under the Name of Gastroentérite, etc. Translated from the original French by H. I. Bowditch, Boston, 1836, 8°, vol. 1. pp. 282 et seq.

[4] Diseases of the Heart and the Aorta, Philadelphia, 1854, pp. 366 et seq.

[5] Untersuchungen über die Myocarditis, München, 1861, 8°, J. J. Lentner, p. 115.

[6] Ueber die Veränderungen der willkürlichen Muskeln in Typhus abdominalis, fol. Leipzig, Vogel, 1864, pp. 29 et seq.

[7] Recherches sur les rapports existant entre la mort subite et les altérations vasculaires du coeur dans la fièvre typhoïde, Arch. de phys , 1869, vol. ii. p. 698. Des complications cardiaques de la fièvre typhoïde, Gaz. hebd. de méd., Paris, 1874, 25, vol. xi. pp. 796, 815.

[8] Sur les alérations du myocarde (désintegration granuleuse) comme cause de la mort subite dans la fièvre typhoïde, Compt. rend. de la Soc. de biol., 1885, 8s., vol. ii. p. 769

[9] Ueber die Erkrankungen des Herzmuskels bei Typhus abdominalis, Scharlach und Diphtherie, Deutsch. Arch. f. klin. Med., 1891, vol. xlviii. p. 369; 1892, vol. xlix. 413.

[10] Contribution à l'histoire de l'artérite typhoïdique; de ses conséquences hâtives (mort-subite) et tardives (myocardite scléreuse) du coeur, Rev. de méd., Paris, 1885, vol. v. p. 843. LANDOUZY, La fièvre typhoïde dans ses rapports avec l'appareil vasculaire et cardiaque, Gaz. d. hôp., Paris, 1886, vol. lix. p. 323. LANDOUZY et SIREDEY, Étude sur les localizations angio-cardiaques typhoïdiques, leurs conséquences immediates, prochaines et éloignées, Rev. de méd., Paris, 1887, vol. vii. pp. 804, 919,

[11] Les myocardites aiguës, Congrès Français de médecine—V. session, Lille, 1899; Paris, 1899, t. ii. pp. 1–83.

[12] État des artères du coeur dans les myocardites aiguës, Congrès Français de méd., 1899, vol. v. p. 280. MOLLARD, Les troubles cardiaques dans la convalescence de la fièvre typhoïde, Presse méd., Paris, 1900, vol. i. pp. 19–22.

[13] Il miocardio nelle infezioni, intossicazioni, avvelenamenti. Ricerche anatomo-patologiche e sperimentali, Policlinico, Roma, 1901, viii., M., pp. 145–155.

[14] Experimentelle Untersuchungen über Kreislaufstörungen bei acuten Infectionskrankheiten, Deutsch. Arch. f. klin. Med., 1903, vol. lxxvii. p. 1.

The part played by infectious processes in the ætiology of acute and chronic changes in the vessels is also a point toward which considerable attention has been directed in recent years.

The relative frequency of venous thrombosis in typhoid fever is familiar enough, and the probability that this is, in many instances, associated with a phlebitis depending upon local infection would seem to result from various studies of recent years.

The not infrequent arterial thromboses and acute arteritides, notably of the vessels of the extremities and of the brain, which have been studied particularly by French observers, need not be recalled. Potain[1] has called attention to the occurrence of acute aortitis.

The influence of infectious diseases in general on the production of the more insidious endarteritic changes in the aorta and other vessels—in other words, the relation of acute infections to the development of atheroma of the aorta and arterio-sclerosis in general—is a question of great importance, to which, it seems to me, we have scarcely directed sufficient attention. Numerous observers have noted the frequency of fresh gelatinous and fatty sclerotic plaques in the aorta and larger vessels in individuals dead of various acute infectious diseases, while Gilbert and Lion,[2] Crocq,[3] and others have produced sclero-calcareous and fatty sclerotic changes in the aorta of rabbits by the injection of pathogenic bacteria after previously inflicting slight mechanical injury to the walls. Indeed, Gilbert and Lion have, in several instances, succeeded in producing changes which they believe to be closely analogous to those observed in human arterio-sclerosis by the intravascular injection of pathogenic organisms without the previous production of a point of least resistance by injury. On the other hand, Thoma[4] mentions typhoid fever among the ætiological elements in the production of that angiomalacia which he believes to be the primary lesion in the development of arterio-sclerosis.

In brief, there is much which goes to suggest that acute infections, and typhoid fever among them, play an important part in the ætiology of arterio-sclerosis. Some observers who have especially studied this question believe that after acute rheumatism typhoid fever is the infectious disease most frequently resulting in changes in the heart and vessels.

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[1] De l'aortite typhique, Semaine méd., Paris, 1894, vol. xiv. p. 460.

[2] Artérites infectieuses expérimentales, Comptes rend. de la Soc. de biol., Paris, 1889, 9s., vol. i. p. 583.

[3] Contribution à l'étude expérimentale des artérites infectieuses (abstr.), Arch. de méd. exp. et d'anat. path., Paris, 1894, vol. vi. pp. 583–600.

[4] Ueber das elastiche Gewebe der Arterienwand und die Angiomalacie, Verhandlungen des XIII. Cong. f. inn. Med., Wiesbaden, 1895, p. 465.

The observations of Landouzy and Siredey[1] are especially striking. These authors report the case of a man, aged twenty-three years, who died suddenly on the fifteenth day of typhoid fever. Two years before he had passed through a serious typhoid infection of six weeks' duration. The heart muscle showed extensive acute inflammatory and degenerative changes in association with grave older sclerotic alterations. There was nothing in the history of the patient, beyond his previous typhoid fever, to which these alterations could be ascribed. Out of 15 typhoid patients between five and forty-eight years of age, followed by Landouzy for a period of nine years, there were 3 in whom marked cardiac disturbance had persisted after recovery from the acute disease. These 3 patients, five, three, and two years after the disease, all showed a certain degree of hypertrophy, with cardiac irritability. As a result of their study, Landouzy and Siredey maintain among their conclusions that: "The secondary angio-cardiac complications of typhoid fever are more frequent than is generally believed and than has been generally acknowledged up to the present time.

"After acute articular rheumatism, typhoid fever appears to give rise to more angio-cardiac complications than any of the other infectious diseases.

"Among the most important and commonest of these complications are those which arise insidiously during the course or decline of the disease. The angio-cardiac lesions are important to recognize, less because of the prognostic reserve which they demand during the course of the disease itself (collapse, sudden death) than for that which they impose upon us for the future."

And Lacombe,[2] among the conclusions of his thesis, maintains that: "The disorders of the heart appearing some years after recovery from typhoid fever may be legitimately ascribed to this disease, if no other malady capable of compromising the integrity of the heart, either before or after the typhoid, has occurred."

* * *

The communications of Landouzy and Siredey especially suggested to me that it might be of interest to make a series of observations as to the condition of the heart and vessels in a number of individuals who had had typhoid fever in the wards of the Johns Hopkins Hospital during the past fourteen years, comparing these results with the previous hospital records, which, in many instances, are fairly complete. This proceeding appealed to me the more because, so far as I know, it has never been previously attempted. With this end in view, I sent out letters to all patients who had had typhoid fever in the wards of the hospital since its opening in 1889—over 1400 in all. In the majority of instances, as might have been expected, the letters failed to reach their destination and were returned, but 183 patients presented themselves for examination.

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[1] Op. cit., 1885.

[2] Localizations angiocardiaques de la fièvre typhoïde, Paris, 1890, 4°.

The majority of these patients were examined at the hospital between 3 and 5 o'clock on Sunday afternoons. About 30 per cent. of the cases were studied in the Out-patient Department between the hours of 10 and 12 in the morning. The measurements of the heart, the record of the pulse, and the estimations of the blood pressure were made in the recumbent posture for comparison with the hospital records.

Age and Date of Attack.

The ages of the patients varied between three and sixty-nine years, while the periods which had elapsed between the discharge from the hospital and the subsequent examination ranged from one month to thirteen years. In all cases the patient was questioned as to the maladies from which he might have suffered since his discharge from the hospital. The following table will show the period of time which had elapsed between the discharge from the hospital and the subsequent examination of the patients:

Table I.

Showing the length of time which had elapsed between the discharge of the patient from the hospital and his subsequent examination.

Months.		Years.												
1-6[1]	6-12	1	2	3	4	5	6	7	8	9	10	11	12	13
22	26	18	20	23	21	11	13	11	8	6	2	0	1	1 = 182

Pulse.

(*a*) *Rate.* Most of the patients at the time of their examination had already rested for some little period of time after their arrival at the hospital. In a large proportion of the cases, however, there was a manifest nervousness; no more, probably, than is common on the examination of any one under similar circumstances; perhaps a trifle less, inasmuch as the patients were for the most part old friends.

The following table shows the rate of the pulse in 182 cases:

Table II.

Rate of the pulse per minute.

50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130	Not noted.	Total.
1	17	42	50	26	23	8	8	17	182

In this table it will be seen that in 110 instances, or 60.4 per cent. of the cases, the pulse ranged between 60 and 90. In 16 instances, or 8.7 per cent., it was above 110.

(*b*) *Regularity.* In 30 instances irregularity of the pulse was noted; four of these were cases in which the rate was not recorded.

Of the cases in which the pulse was over 90, irregularity was noted in 18.3 per cent.

Of the cases in which the pulse was under 90, irregularity was observed in 12.7 per cent.

(*c*) *Intermittence.* In only 3 instances was the pulse distinctly intermittent. One of these was a well-marked case of hypertrophy with mitral insufficiency. There were 2 cases in which a strikingly collapsing character of the pulse was noted. In each of these instances an aortic diastolic murmur was present.

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[1] There were but three cases seen under three months from the time of discharge.

BLOOD PRESSURE.

In 165 of these cases the systolic blood pressure was taken by means of the Riva-Rocci apparatus. This proceeding was made the last step in the examination, in order that the patient might be in as placid a condition as possible. The estimations were repeated several times until constant readings were obtained. The band was always placed around the middle of the upper arm, right or left.

The results of these estimations are indicated in the following table:

TABLE III.

Showing the averages of the systolic blood pressure in 165 old typhoids arranged by age according to decades.

1–10	10–20	20–30	30–40	40–50	50–60	60–70
112.4 mm. (5 cases.)	135.2 mm. (39 cases)	153.5 mm. (58 cases.)	161.5 mm. (44 cases.)	170.2 mm. (15 cases.)	179.6 mm. (3 cases.)	215 mm. (1 case.)

Struck by the high averages of the systolic blood pressure in this group of cases, I sought for statistics with which these figures might be compared, but soon found that it would be necessary, in order to reach a fair conclusion, to make myself a series of observations upon normal individuals under conditions as similar as might be. I have, therefore, in the last several months made 276 estimations of the blood pressure in presumably healthy individuals. These observations were made upon physicians, nurses, and employés of the hospitals, friends of patients, healthy children in several different asylums and schools, and upon various of my own friends. I did not allow myself to record the blood pressure of any patient, surgical or medical, no matter what his complaint. The records were taken between the hours of 3 and 5 in the afternoon or between 10 A.M. and 1 P.M.; in other words, several hours after a meal. They were all taken in the recumbent posture, sufficient time being taken to allow the individual to recover from the preliminary nervousness; that is, under conditions similar to those employed in making the observations upon the previous group of patients. The averages of this table, which may be seen upon Chart I., show a distinctly and uniformly lower blood pressure than in the old typhoids.

TABLE IV.

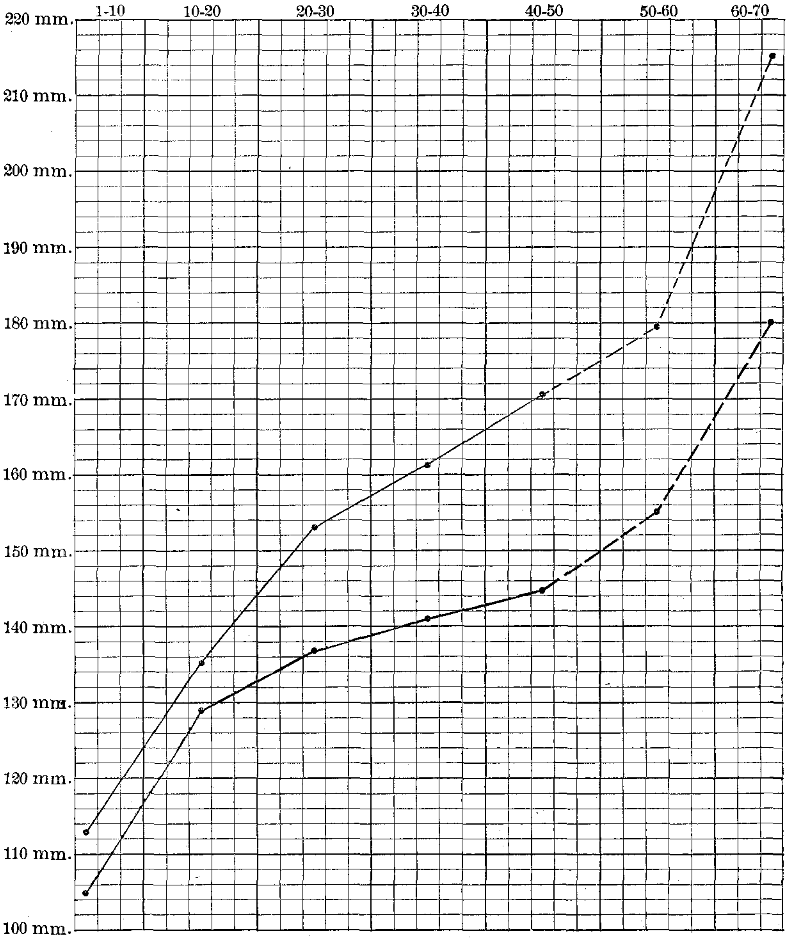
Showing the averages of the systolic blood pressure in 276 healthy individuals and 165 old typhoids arranged according to age by decades.

	1–10	10–20	20–30	30–40	40–50	50–60	60–70
Old typhoids.	112.4 mm. (5 cases.)	135.2 mm. (39 cases.)	153.5 mm. (58 cases.)	161.5 mm. (44 cases)	170.2 mm. (15 cases.)	179.6 mm. (3 cases.)	215 mm. (1 case.)
Healthy individuals.	104.6 mm. (37 cases.)	128.7 mm. (87 cases.)	136.9 mm. (89 cases.)	140.8 mm. (37 cases.)	142.2 mm. (20 cases.)	154 8 mm. (5 cases.)	180 mm. (1 case.)

Inasmuch as all observers agree that the average blood pressure is slightly lower in women than in men, it may be well to note that the proportion of women was higher among the old typhoids than among the cases from which the control table was constructed, the exact figures being 38.7 per cent. for the old typhoids and 33.3 per cent. for the normal cases.

CHART I.

SHOWING AVERAGES OF THE SYSTOLIC BLOOD PRESSURE IN 165 OLD TYPHOIDS AND IN 276 HEALTHY INDIVIDUALS ARRANGED ACCORDING TO AGE BY DECADES.



OLD TYPHOIDS	112.4 (5 CASES)	135.2 (39 CASES)	153.5 (58 CASES)	161.5 (44 CASES)	170.2 (15 CASES)	179.6 (3 CASES)	215 (1 CASE)
HEALTHY INDIVIDUALS	104.6 (37 CASES)	128.7 (37 CASES)	136.9 (89 CASES)	140.8 (37 CASES)	142.2 (20 CASES)	154.8 (5 CASES)	180 (1 CASE)

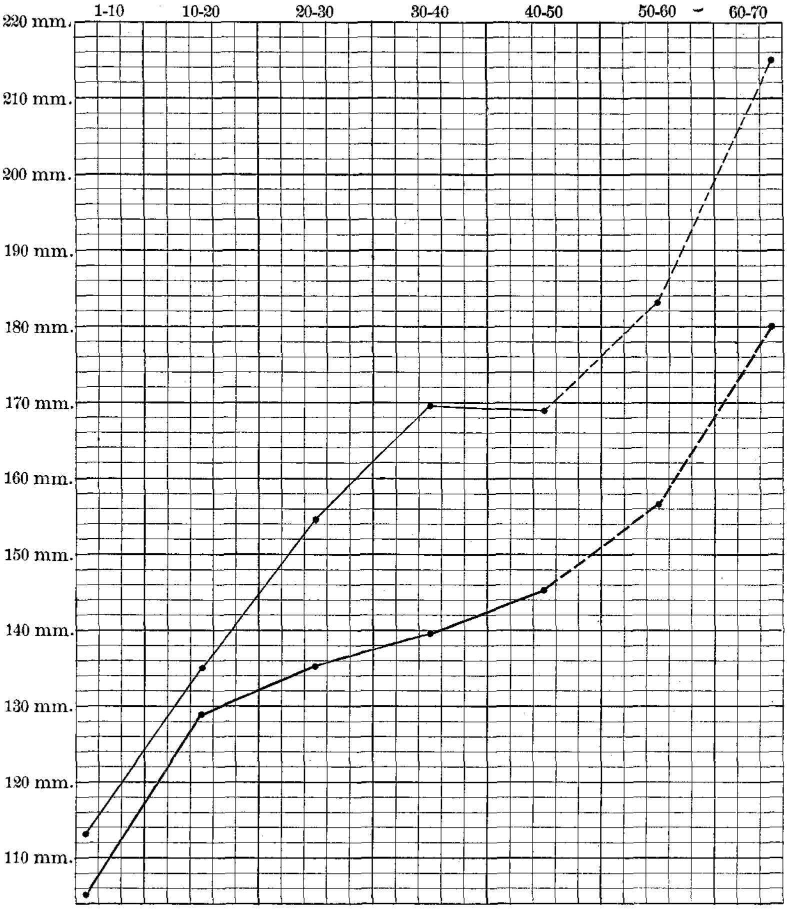
On the other hand, more of the normal cases were examined during the morning hours than of the old typhoids, the percentage being 40.5 per cent. to 30.3 per cent.

A closer analysis of the figures upon which these tables are based reveals the fact that among the old typhoids there were 54 cases in which the blood pressure was above 160; this group comprises over 50 per cent. of the cases over thirty years of age.

In the much larger number of observations upon healthy individuals there were but 10 such cases, 6 of which gave a history of preceding serious infectious disease, while in 1 there was a good suspicion of alcoholism. Of the 54 old typhoids, in but 17 was a similar history obtainable.

CHART II.

SHOWING THE AVERAGES OF THE SYSTOLIC BLOOD PRESSURE IN OLD TYPHOIDS AND IN NORMAL INDIVIDUALS FROM WHOM ALL CASES WITH A HISTORY OF SERIOUS INFECTIOUS DISEASE OR ALCOHOLIC HABITS HAVE BEEN EXCLUDED.



OLD TYPHOIDS	113.2 (4 CASES)	134.9 (28 CASES)	152.2 (32 CASES)	169.9 (24 CASES)	168.7 (8 CASES)	183.5 (2 CASES)	215 (1 CASE)
HEALTHY INDIVIDUALS	105.5 (32 CASES)	128.3 (62 CASES)	135.1 (52 CASES)	139.8 (19 CASES)	145.2 (11 CASES)	156.2 (4 CASES)	180 (1 CASE)

The highest record of blood pressure among the cases in healthy individuals was 180, and that in a woman aged sixty years, while among the old typhoids there were 27 cases in which the pressure was above 180, a number of which were striking examples of hypertension, 10 showing a record of 200 or above.

It might be objected that to ascribe this difference between the two curves to changes dependent upon the preceding typhoid fever would be a rash conclusion, inasmuch as a great number of other influences must have come into play, while the number of cases studied is too small to justify positive conclusions. In order to rule out some of these disturbing influences, I have prepared a table in which I have eliminated from each list all those cases in which a history of scarlet fever, diphtheria, acute rheumatism, pneumonia, erysipelas, smallpox, syphilis or alcoholic habits could be obtained. This table, which is represented graphically on Chart II., shows essentially the same relation between the two curves:

TABLE V.

Showing the averages of the blood pressure in old typhoids and normal individuals, from which all cases with a history of serious infectious disease or alcoholic habits have been excluded.

			Old typhoids.			
1–10	10–20	20–30	30–40	40–50	50–60	60–70
118.2 mm.	134.9 mm.	152.2 mm.	169.9 mm.	168.7 mm.	183.5 mm.	215 mm.
(4 cases.)	(28 cases.)	(32 cases.)	(24 cases.)	(8 cases.)	(2 cases.)	(1 case.)
			Healthy individuals.			
105.5 mm.	128.3 mm.	135.1 mm.	139.8 mm.	145.2 mm.	156.4 mm.	180 mm.
(32 cases.)	(62 cases)	(52 cases.)	(19 cases.)	(11 cases.)	(4 cases.)	(1 case.)

The average of the observations upon healthy individuals is about 2 mm. less than in the uncorrected list. That of the typhoid observations is practically unchanged. The alteration in the typhoid curve on the chart arranged by decades, due to the higher figures in the 30–40 column, emphasizes the fact that the number of cases is still too small to allow of the construction of final charts.

PALPABILITY OF THE RADIAL ARTERIES.

Note was also made of the palpability of the radial arteries. In order to obviate the common confusion arising from a full vessel or engorgement of the venæ comitantes, the blood was milked out of the artery and veins with the fingers of both hands, the tense tissues relaxed, while with a third finger an attempt was made to feel the empty vessel. The following table will show the results of observations on 181 old typhoids:

TABLE VI.

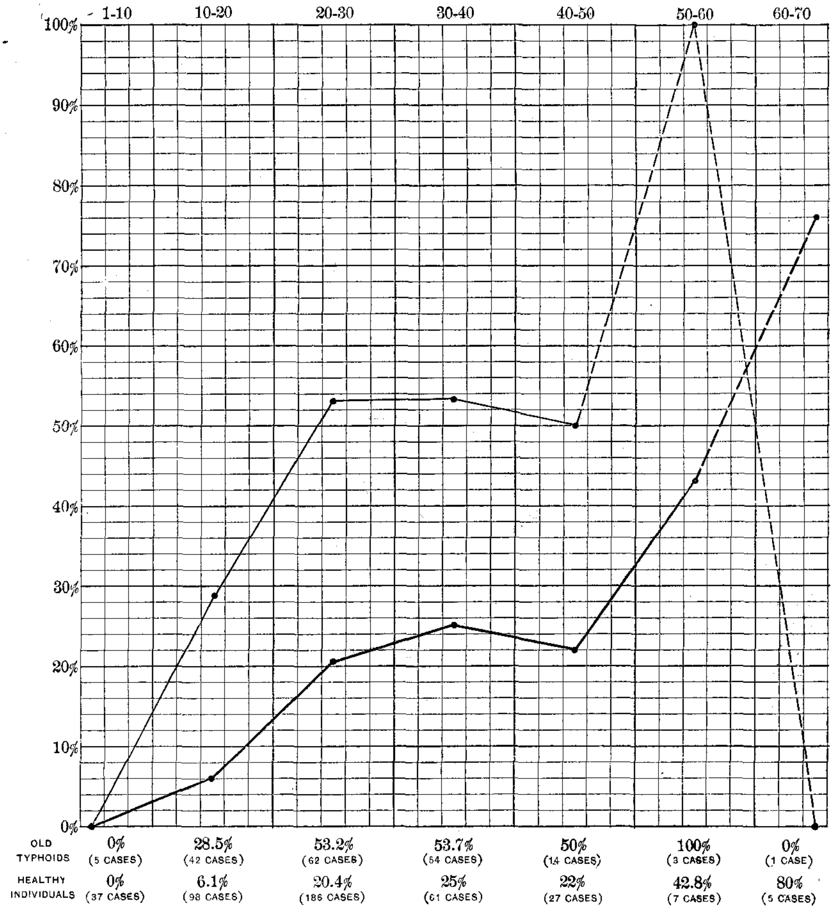
Showing the palpability of the radial arteries in 181 cases arranged by age according to decades.

Age.	Cases.	Not palpable.	Palpable.	Per cent. of palpable vessels.
1–10	5	5	0	0
10–20	42	30	12	28.5
20–30	62	29	33	53.2
30–40	54	25	29	53.7
40–50	14	7	7	50
50–60	3	0	3	100
60–70	1	1	0	0

A glance at these figures reveals the striking fact that over 50 per cent. of our cases above twenty years of age showed palpable radial arteries. In 2 instances in which the radials were not palpable, 1 the

CHART III.

SHOWING THE PERCENTAGES OF PALPABILITY OF THE RADIAL ARTERIES IN OLD TYPHOIDS AND IN HEALTHY INDIVIDUALS ARRANGED ACCORDING TO AGE BY DECADES.



case of a man aged twenty-five years, and 1 that of a woman aged forty-seven years, one or the other of the temporal arteries was distinctly thickened. In general, I have in these studies been impressed with the irregularity in the distribution of the sclerotic processes in peripheral vessels. It is by no means uncommon to find one radial or temporal distinctly thickened or tortuous, while the other is apparently unaffected.

A comparison of the observations recorded in this table with those made upon the patients while in the hospital is of little value, in view of the fact that a definite note as to the palpability of the radials was made in but 48 cases. These figures, which were even more striking than the high averages of blood pressure, could, it seemed to me, be fairly compared only with a similar series of observations made by myself upon supposedly healthy individuals who had not suffered from typhoid fever. Within the last several months, accordingly, I have examined the radials and temporals of 421 individuals who have never had typhoid fever. The accompanying table, illustrated on Chart III., shows a comparison of the percentages of palpable radials arranged by decades in our old typhoids and in healthy individuals:

TABLE VII.

Showing the percentages of palpability of the radial arteries in old typhoids and in healthy individuals arranged according to age by decades.

	1–10	10–20	20–30	30–40	40–50	50–60	60–70
Old typhoids.							
	0 %	28.5 %	53.2 %	53.7 %	50 %	100 %	0 %
	(5 cases.)	(42 cases.)	(62 cases.)	(54 cases.)	(14 cases.)	(3 cases.)	(1 case.)
Healthy individuals.							
	0 %	6.1 %	20.4 %	25 %	22 %	42.8 %	80 %
	(37 cases.)	(98 cases.)	(86 cases.)	(61 cases.)	(27 cases.)	(7 cases.)	(5 cases.)

By these figures it appears that between the ages of ten and fifty years 46.8 per cent. of the old typhoids showed palpable vessels as compared with 17.6 per cent. of the normal cases.

I have also prepared comparative tables, as in the case of the records of blood pressure, based upon an analysis of those cases only in which a history of serious infections or of habits which might induce arterio-sclerosis was wanting. This table is illustrated by Chart IV.

TABLE VIII.

Showing the percentages of palpability of the radial arteries in old typhoids and in healthy individuals from which all cases giving a history of serious infections or alcoholism have been excluded.

	1–10	10–20	20–30	30–40	40–50	50–60	60–70
Old typhoids.							
	0 %	22.5 %	54.2 %	62.9 %	57.1 %	100 %	0 %
	(4 cases.)	(31 cases.)	(35 cases.)	(27 cases.)	(7 cases.)	(2 cases.)	(1 case.)
Healthy individuals.							
	0 %	4.2 %	21.3 %	22.2 %	18.7 %	33.3 %	75 %
	(32 cases.)	(70 cases.)	(103 cases.)	(27 cases.)	(16 cases.)	(6 cases.)	(4 cases.)

As in the case of the observations upon the blood pressure, the total average is slightly lower among the healthy individuals—15.1 per cent. : 17.5 per cent. Among the typhoids the average palpability of the vessels in this list varies but little from that in the previous table—45.7 per cent. : 46.1 per cent.

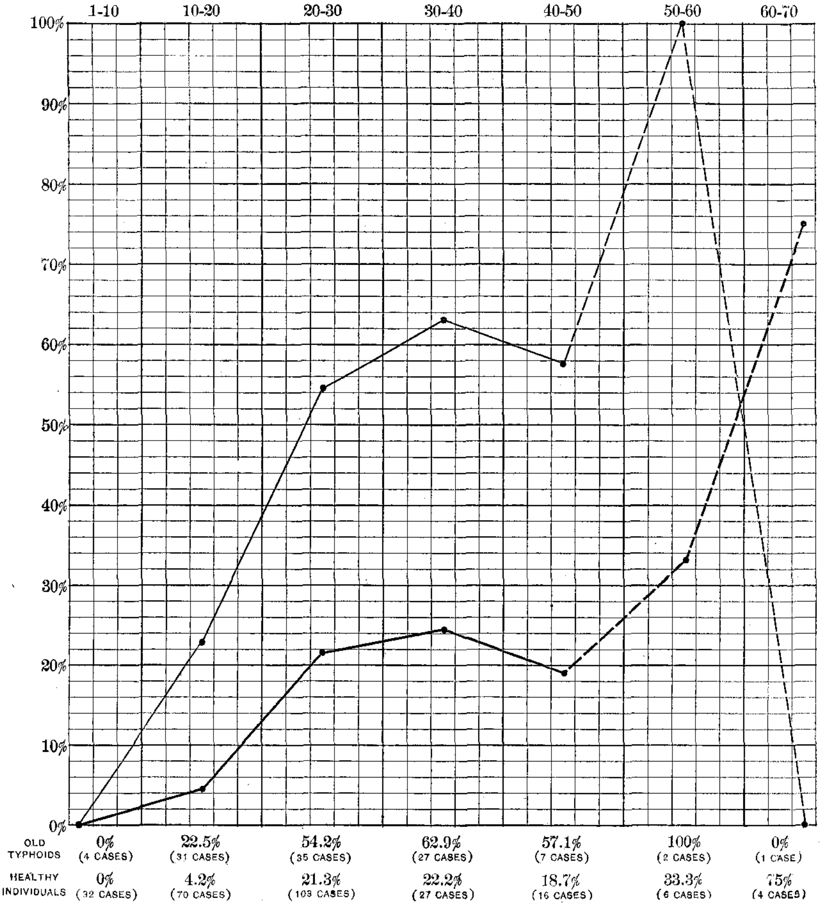
HEART.

Position of the Apex. Measurements of the distance of the apex of the heart from the median line were made in 180 of the old typhoids. The average distance of the apex from the median line as determined by palpation, percussion, and auscultation in individuals between the ages of twenty and fifty years was 9.12 cm.

Similar measurements made in 102 of these cases on admission to the hospital showed an average of 8.7 per cent.

CHART IV.

SHOWING THE PERCENTAGES OF PALPABILITY OF THE RADIAL ARTERIES IN OLD TYPHOIDS AND IN HEALTHY INDIVIDUALS AFTER THE REMOVAL FROM EACH LIST ALL CASES IN WHICH THERE IS A HISTORY OF SEVERE INFECTIOUS DISEASE OR OF ALCOHOLIC HABITS.



The following table shows the averages, arranged according to age by decades, of 102 cases which were examined on admission to the hospital, side by side with the records of those examined later:

TABLE IX.

Showing the average distance of the cardiac apex from the median line in 102 cases of typhoid fever on admission to the hospital, and of 180 cases examined later.

1-10	10-20	20-30	30-40	40-50	50-60	60-70
Old typhoids.						
6.3 cm.	7.7 cm.	8 9 cm.	9.1 cm.	9.8 cm.	9.5 cm.	12 cm.
(5 cases.)	(41 cases.)	(63 cases.)	(52 cases.)	(15 cases.)	(3 cases.)	(1 case.)
During attack.						
5.7 cm.	6.6 cm.	8.5 cm.	8.5 cm.	9.6 cm.		
(5 cases.)	(36 cases.)	(38 cases.)	(14 cases.)	(9 cases.)		

It will be noted that the average measurements in the old typhoids are slightly but constantly larger than in the cases examined on admission to the hospital. Though this difference, as shown by the table, is trivial, it should, perhaps, be borne in mind that there is not infrequently in typhoid fever a slight dilatation of the heart, and that most of these examinations were made when the fever was well under way.

Inasmuch as 46 of these cases entered the hospital when they were under twenty years of age, that is, at a time when, in many instances, they had not attained full development, it seemed wise to investigate the position of the apex in individuals over twenty years at the time of their admission, where notes had been made both in the hospital and subsequently. There were 59 such cases. At the time of admission the average distance of the apex from the median line was 8.82 cm.; subsequently it was 9.14 per cent., a slight difference, but one which corresponds closely with the larger averages.

Extent of the Cardiac Dulness to the Right. In 158 cases examined by myself a note was made as to the extent of the cardiac dulness to the right of the midsternal line. The average distance for each decade is shown in the following table:

TABLE X.

Showing the average extent of the cardiac dulness to the right of the midsternal line in 158 old typhoids arranged according to age by decades.

1-10	10-20	20-30	30-40	40-50	50-60	60-70
2.4 cm.	3.12 cm.	3.45 cm.	3.39 cm.	3.47 cm.	3.4 cm.	5 cm.
(3 cases.)	(36 cases.)	(54 cases.)	(47 cases.)	(14 cases.)	(3 cases.)	(1 case.)

The greatest extent of dulness to the right of the median line among these cases was 5 cm., in a man with dilated heart and mitral insufficiency.

In but 1 case, that of a man aged thirty years, was no dulness to the right to be made out. This case accounts in great part for the slightly lower average in the fourth decade.

There is nothing remarkable about these figures, which are, indeed, a trifle smaller than those given by Riess.[1]

Heart Sounds, In the Hospital. In 170 of these cases in which notes with regard to the condition of the heart sounds were made in the hospital, murmurs were noted in 39 instances, or 29 per cent. In 31 cases the murmur was a soft systolic blow heard at the apex, and only once was the sound transmitted to the axilla. In a number of cases this murmur was heard only on admission or at the height of the disease, disappearing with convalescence. In 5 of these 31 cases the pulse in the hospital was above 140, one case, however, being under fifteen years of age.

On Later Examination. Notes on the heart sounds were made in all but 2 of the 183 old typhoids. 88, or 48.6 per cent., of these cases showed murmurs. In all of these the murmurs were systolic, although in 2 instances an aortic diastolic murmur was heard in addition, and in one case a doubtful mitral presystolic.

In only 38 cases was the systolic murmur audible at the apex. In the majority the murmur was a soft blow, with its maximum intensity at the base of the heart, in the pulmonic or aortic area.

In 11 cases an apex systolic murmur was transmitted to the axilla, and in 7 was audible also in the back. In 7 cases the symptoms justified the diagnosis of mitral insufficiency (Nos. 9921, 10,704, 10,714, 31,173, 17,636, 28,249, 36,210). One further case (20,507), an instance of aortic insufficiency, showed also evidences of mitral incompetency. In one case (32,037) there were signs suggesting mitral stenosis.

In 2 instances aortic diastolic murmurs were heard in cases which had previously shown no evidence of cardiac trouble (39,371, 26,507). One of these individuals, who was examined nearly four months after discharge from the hospital, was seen again five months later, at which time the diastolic murmur had entirely disappeared and the size of the heart had slightly diminished. This case must probably be regarded as one of functional insufficiency, due to relaxation of the aortic ring.

Reduplication of the First Sound. In 14 of the old typhoids a reduplication of the first sound at the apex or tricuspid area was observed. One of these was a case of well marked hypertrophy, with mitral insufficiency; another was a case of Graves' disease, with high arterial tension. In general, it was noted that the arterial tension in cases showing reduplication of the first sound was high, the average pressure being 164.9. In 3 cases the pressure was above 200. In only one of these reduplications did it seem possible to determine the cause of the split in the first sound. In this case it was clearly due to delay in the closure of the tricuspid valve.

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[1] Sahli. Lehrbuch der klinischen Untersuchungsmethoden, Leipzig u. Wien, 8 Auflage, 1901, 8°, p. 165.

Reduplication of the Second Sound. In 82 of the old typhoids there was a reduplication of the second sound. This, in every instance but one, was audible at the base and usually limited to the pulmonic area. In 73 cases the reduplication was clearly dependent upon delay in the closure of the pulmonic valves. The reduplications were usually slight and heard only at the end of inspiration—cases such as would fall into Galli's[1] class of "reduplications of the first grade." In 10 cases, however, the reduplication was heard throughout the entire cycle.

The proportion of reduplications is not far from that observed by Galli, who, in his 120 carbineers, found 19 per cent. of such reduplications in the morning, 40 per cent. at noon, 56 per cent. in the afternoon.

The blood pressure of these cases was slightly below the general average for the old typhoids of the same decades—148.3 : 152.

Accentuation of the Second Sound. Out of 161 cases in which the relative accentuation of the aortic or pulmonic second sounds was noted, the pulmonic second was accentuated in 82, or 50.9 per cent. The following table will show the relative percentages of accentuation of the second aortic sound, arranged according to decade:

TABLE XI.

Showing the percentage of cases in each decade in which the aortic second sound was accentuated.

1–10	10–20	20–30	30–40	40–50	50–60	60–70
20 %	30.3 %	48.2 %	44.6 %	46.6 %	100 %	100 %
(5 cases.)	(33 cases.)	(58 cases.)	(47 cases.)	(15 cases.)	(2 cases.)	(1 case.)

Compared with the figures of Cabot,[2] the percentages in the lower decades are high, while those above the third decade are low. I do not, however, attach any great importance to these figures. In using the term "accentuated" I have intended to indicate that sound which was actually the louder of the two. In a number of instances, however, the second aortic sound, while not apparently as loud as the second pulmonic, was ringing, liquid, musical and suggestive of high tension. Again, the study of reduplications of the second sound, among other things, proves, I think, clearly that in many instances the closure of the aortic valve plays the greater part in the production of the loud sound which one hears in the pulmonic area.

SUMMARY OF THE GENERAL ANALYSES.

To summarize the results of these general analyses we have found:

1. That our old typhoids show an average blood pressure higher than that observed in control tables of normal subjects of the same age and under the same conditions, while the individual

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[1] Münch. med. Wochenschr., 1902, vol. xlix. pp. 95, 1005, 1049.

[2] Physical Diagnosis of Diseases of the Chest, 2d ed., 1903, 8°, p. 124.

records in a considerable proportion of cases exceed the figures usually regarded as normal.

2. That in these same cases the radial arteries are palpable with much greater frequency than was observed in a series of control observations in individuals who had never had the disease.

3. That there is some evidence of cardiac enlargement, as indicated by the results of measurements of the distance of the apex from the median line when compared with figures for the same decade resulting from observations made at the time of admission to the hospital.

4. That there were among these 182 old typhoids 10 instances of cardio-vascular lesions, which had developed following typhoid fever in the absence of the ordinarily recognized ætiological elements; 7 cases of hypertrophy with mitral insufficiency (10,704, 10,714, 31,173, 17,636, 24,675, 28,249, 36,210);[1] two of aortic insufficiency (39,371, 20,507); one of marked arterio-sclerosis with hyper-tension in a young man (17,632).

In addition to these cases there was one instance of possible mitral stenosis (32,037).

* * *

Are the more serious cardio-vascular manifestations during typhoid fever common precursors of permanent lesions? Is it in cases presenting such symptoms that the grave, later changes develop? Is it possible to recognize at the time of their origin the development of those processes which subsequently exert a permanent effect upon the organism?

In order to obtain some light upon these questions, it was determined to examine separately into the subsequent condition of:

1. Those cases in which, during the attack, extreme rapidity of the pulse was noted.
2. Those cases where irregularity of the pulse was observed.
3. Those cases in which an apical systolic murmur was heard.

1. The Subsequent Condition of Those Cases of Typhoid Fever in Which Extreme Rapidity of the Pulse was Noted during the Attack.

Rate of the Pulse: In 19 cases a pulse of 140 or above was recorded during the attack. 9 of these patients were under twenty years of age at the time of admission. The rate of the pulse in the remaining 10 cases on subsequent examination shows no great variations from the general average. In 2 instances the rate was not noted. In one, a case of Graves' disease, it was 120; in one, 104; in one, 92; and in the other 5 instances, or 50 per cent., the pulse was between 68 and 84.

Systolic Blood Pressure. Of the 19 cases in which an extremely rapid pulse was observed in the hospital, 9 who were under twenty years of age have been omitted from the list; it is easily conceivable that in individuals under twenty years a pulse of 140 may not represent the same conditions as a pulse of that rate at a later age. Of the remaining 10 cases, varying in age from twenty-two years to fifty-three years, the average systolic pressure was 166.8. The general average of the old typhoids for these decades was 159.2. There were among these 10 cases, 2 with a blood pressure above 200, and 5, or 50 per cent., with a pressure above 160.

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[1] In one other case (9921) it is well possible that the typhoid fever may have been the exciting cause of the condition.

Palpability of the Radial Arteries. In 4, or 40 per cent. of these 10 cases, the radial artery was palpable. The general average for these decades among the old typhoids was 53.7 per cent.

Position of the Apex of the Heart. In only 4 of the 10 cases were measurements made during the disease. The average distance of the apex from the median line in these cases was 7.37 cm. In 10 cases examined subsequently the average distance was 8.48 cm. In the 4 cases in which a hospital record was made the average distance of the apex from the median line in the later examinations was 8.5 cm. If we compare these figures with the average of the measurements on admission to the hospital—8.82—and the average for the old typhoids—9.14—we find that they are lower in both instances. The difference, however, between the measurements during the disease and later is greater in the smaller group.

Extent of the Cardiac Dulness to the Right. In none of these 10 cases were measurements of the cardiac dulness to the right made during the fever. The average extent of dulness to the right of the median line on subsequent examination was 3.61, or slightly more than the total average for the same decades—3.44.

In review, then, we have found that in 10 cases over twenty years of age who, during their typhoid fever, showed extreme rapidity of the pulse, there was on subsequent examination, an average blood pressure somewhat higher than that observed in the mean of the whole 165 cases; the percentage of palpability of the radial arteries was less; the distance of the apex of the heart from the median line was somewhat less; while the extent of the dulness of the heart to the right of the median line was a trifle above the general average. The increase in the size of the heart during the period subsequent to the illness was somewhat above the general mean. Two cases showed distinct hypertrophy, with hyper-tension (11,331 and 14,675); in one of these there was evidence of mitral insufficiency.

2. SUBSEQUENT CONDITION OF THOSE CASES IN WHICH IRREGULARITY OF THE PULSE WAS NOTED DURING THE ATTACK.

Rate and Rhythm of the Pulse. Irregularity of the heart's action was noted in 12 cases during the attack. In 1 of these the irregularity occurred in association with the bradycardia (46) of convalescence. In 2 cases irregularity was observed on the subsequent examination. In the remaining 10 nothing remarkable was noted as to rate or rhythm of the pulse.

The Systolic Blood Pressure. In 11 of these 12 cases the average blood pressure on the later examination was 152.2 mm., as compared with the general average of 152 mm. 3 cases were under fifteen years of age. If we put aside these 3 cases in which the average pressure was 113.3 mm., there are left 8 cases, aged between twenty years and forty-two years, in whom the average pressure was 166.8 mm. The average pressure among the old typhoids for these decades was 158.6 mm. In 2 instances the pressure was above 200.

Palpability of the Radial Arteries. The radial arteries were palpable in but 3, or 27.2 per cent., of these cases.

Position of the Apex. The position of the apex was noted in the hospital in 9 of these cases. In 4, under twenty years of age, the average distance of the apex from the median line was 7.12 cm. In 5, over twenty years, the average distance was 8.2 cm. Of the 12 cases on the later examination, in 3, under twenty years of age, the average distance of the apex from the median line was 6.6 cm. In 9, over twenty years, it was 8.18 cm. In the 4 cases in which a hospital note was made the average distance of the apex from the median line on subsequent examination was 8 cm., or 0.2 cm. less than the average in the hospital.

Extent of Dulness to the Right. In none of these cases was a measurement made in the hospital of the extent of the cardiac dulness to the right. In 11 instances a record was made on the later examination. In 3 cases, under twenty years of age, the average was 3 cm. In 8 cases, over twenty years, the average was 3.35 cm.

Review. In the 12 cases which in the hospital showed irregularity of the pulse, as in the cases with rapid pulse, the blood pressure, on later examination, was found to be distinctly higher than the general mean of the 165 old typhoids. On the other hand, there was no evidence of cardiac enlargement; the distance of the apex from the median line was, indeed, less than in the general mean, or in the same cases on admission to the hospital. The percentage of palpability of radial arteries was also lower than the general average.

3. The Subsequent Condition of Those Cases in Which an Apical Systolic Murmur was Noted during the Attack.

The Rate of the Pulse. Of the 31 patients in whom during their fever a systolic murmur was observed, in 29 the rate of the pulse was noted in the subsequent examination. Twenty-one, or 72.4 per cent. of these cases, showed a pulse between 76 and 88. In 2 instances the pulse was between 90 and 100; in 5, between 100 and 110; and once only 120, a case of Graves' disease. When these figures are compared with the foregoing records for the total number of cases, it becomes evident that there is no apparent tendency in this group of cases to an increased rapidity of the pulse.

Palpability of the Radial Arteries. In 30 of these cases in which a note as to the palpability of the radial arteries was made, the vessel was to be felt in 11, or 36.6 per cent., as compared with the general average of 46.1 per cent.

The Systolic Blood Pressure. In 28 of these 31 cases the systolic blood pressure was taken in the later examination. The average of these 28 cases was 158.5 mm., against the general average for the total number of cases of 152.4. This higher average was observed in every decade excepting the first, in which there was but 1 case, and the third, in which there were but 4. In 18 cases, over the age of twenty years, the average pressure was 169.2, as compared with the general average of 159.6 for the same decades. In 5 cases the pressure was 200 mm. or above.

Position of the Apex. In 22 of these cases the position of the apex was determined in the hospital, the average distance from the median line being 7.1 cm. In 30 cases a subsequent note was made, the average being 8.9 cm. The former figures are slightly lower than the general average, the latter slightly higher. If we subtract from this list of cases those who were under twenty years at the time of admission, the average becomes 8.54 cm. in 11 hospital cases, against 9.4 cm. in 19 cases examined later. If we further compare only the 11 cases in which notes were made both in the hospital and later, the averages are, respectively, 8.54 cm. and 9.25 cm. Comparing these figures with the general hospital averages for the same decades, 8.70 and 9.22, it is evident that this small group of cases in which systolic murmurs were heard at the apex during their attacks showed, on later examination, measurements essentially the same as in the general average, despite the fact that at the onset of the disease the average for these same cases was slightly below the general mean.

Extent of Cardiac Dulness to the Right. In none of these cases was the dulness to the right measured while the patient was in the hospital. In the subsequent examinations a record was made in 29 cases, the average extent of dulness being 3.39 cm., as compared with the total average for all decades of 3.35. 9 of these patients who were under twenty years of age showed an average measurement of 3.3 cm., as against the general average of 3.08, while the 20 cases over twenty years of age showed an average measurement of 3.43, as compared with the general average of 3.44.

Heart Sounds. In but 2 of the 31 cases in which a systolic apical murmur was heard in the hospital was the sound transmitted to the axilla, and in neither of these instances were the signs such as might have justified a diagnosis of organic cardiac disease.

On the later examination:

In 11 instances the heart sounds were clear.

In 1 case there was a slight cardio-respiratory murmur at the apex.

In 6 cases there was a soft systolic murmur at the base, in some instances heard also over the right ventricle.

In 13 cases there was a systolic murmur at the apex of the heart. Of these 13 cases:

In 5 the murmur was a soft systolic blow heard at the apex, and in 3 instances also over the rest of the cardiac area. In the 2 cases where the murmur was limited to the apex it disappeared in the erect posture.

In 5 the signs justified the diagnosis of mitral insufficiency.

In 1 there were signs suggestive of mitral stenosis.

In 1 there was marked arterio-sclerosis, with hyper-tension, and a slight systolic murmur at the apex, tricuspid, and pulmonic areas.

In 1 there was Graves' disease, with a systolic murmur all over the cardiac area. This condition was present also at the time of the fever.

Review. On considering these figures, we find that the 31 cases in which systolic murmurs were observed during the fever showed, on later examination, nothing remarkable with regard to the pulse, while the palpability of the peripheral arteries was below the general average for the old typhoids.

On the other hand, the blood pressure was strikingly higher than the general average, one-half of the cases of extreme hyper-tension (200 mm. or above) being observed in this small group. The size of the heart was also increased, as compared to the mean of our observations upon the old typhoids, while the actual increase in those cases in which measurements were made in the hospital and later was also greater than the general average.

Seven or nearly one-quarter of these cases, showed, on subsequent examination, evidence of organic cardiac lesions, while another case was a striking example of general arterio-sclerosis, with hyper-tension, in a young individual.

* * *

Among these 183 cases there are several which deserve special attention.

CASE I. *Hypertrophied heart; mitral insufficiency.*—Mrs. H. B. (Hospital No. 9921), aged forty years, was admitted to the hospital on April 19, 1894, where she passed through a typhoid fever of thirty days' duration, complicated with neuritis of the left ulnar nerve. The urine was free from albumin. Previously she had been a healthy woman, excepting for an attack of acute articular rheumatism at six years, and three attacks since then. In the hospital records it was noted that there was no increase in the area of cardiac dulness; that the sounds were clear at the apex. The highest recorded pulse was 116.

On January 5, 1903, the patient reported for examination in answer to my letter. She had had no illness since leaving the hospital. She had, however, complained of late of being somewhat short of breath on exertion. The pulse was 22 to the quarter, regular, of good size, rather long duration. The radial artery was just palpable; temporals not prominent. Systolic blood pressure, 200 mm.

Heart. Point of maximum impulse in the fifth space 10 cm. from the midsternal line. Dulness extends 4 cm. to the right of the midsternal line. At the apex the first sound is replaced by a well-marked blowing systolic murmur; the second is clear. The murmur is heard distinctly throughout the axilla and in the back. It is audible also in the tricuspid, pulmonic, and aortic areas, over the manubrium, and in the carotids. The aortic second sound is sharp, though scarcely as sharp as the second pulmonic, which is accentuated. There are one or two reduplications of the second sound in the pulmonic area at the end of each inspiration, the second part of the split sound being accentuated. This reduplication is occasionally heard in the aortic area, where the accented part is clearly the first.

In this case it is possible that a valvular lesion, though not evident at the period when she was in the hospital, may have dated from her preceding attacks of rheumatism.

CASE II. *Moderate hypertrophy of the heart; mitral insufficiency.*—E. T. E. (Hospital No. 10,704), aged twenty-five years, entered the hospital on August 23, 1894, where he passed through a typhoid fever of very moderate intensity and without complications beyond albuminuria, with granular casts, and some epithelium. He had had measles, scarlet fever, and mumps as a child; no venereal history; used alcohol in moderation. The note on the heart states that: "The point of maximum impulse is in the fourth space, a little inside the mammillary line. Relative dulness not increased to the right. Pulse slow, of good volume and tension. Sounds clear, of normal relative intensity." No further note was made on the heart.

On January 18, 1903, the patient returned for examination. He had been well since discharge. He was rather flushed and excited; pulse, 24 to the quarter, of good size, duration fair; vessel wall just palpable. Brachial pulse visible at the bend of the elbow, and temporals visible, but not especially thickened. Blood pressure, 180 mm.

Heart. Impulse marked in the third and fourth interspaces; of maximum intensity in the fifth interspace in the mammillary line 10.5 cm. from the midsternal line. Dulness extends 3.2 cm. to the right of the midsternal line.

At the apex the first sound is prolonged and followed by a soft systolic murmur, which is heard throughout the axilla; second clear. In the tricuspid area the sounds are clear and sharp. In the pulmonic area the first sound is prolonged and continued into a slight systolic murmur; the second, loud and sharp. The murmur is also heard in the aortic area, over the manubrium and in the carotids.

Occasionally a very slight reduplication of the pulmonic second sound is to be heard at the end of inspiration. In the erect posture a soft systolic souffle is well heard in the left back, though audible at the apex.

There may be some question as to the existence of mitral insufficiency in this case, but the high tension, the rather large size of the heart, and the audibility of the murmur in the left back are suggestive.

Case III. *Hypertrophy and dilatation of the heart; mitral insufficiency.*—J. H. (Hospital No. 10,714), aged sixty-one years, was admitted to the hospital on August 24, 1894, where he passed through a typhoid fever of seventeen days' duration, of moderate severity. The urine during the attack showed a trace of albumin, hyaline and granular casts. He had had previously no serious illnesses; had used alcohol in moderation. The pulse was full, soft, regular in force and rhythm, 92. Tension not increased. Vessel wall not thickened.

Heart. Apex-beat in the fifth space, 3 cm. inside the nipple line. The first sound at the apex was occasionally followed by a soft systolic puff, not transmitted (cardio-respiratory?). Sounds at the base clear, of normal relative intensity.

On January 18, 1903, the patient returned to the hospital in answer to my letter. Up to a week before he had been fairly well. For a week he had been complaining of shortness of breath on exertion. He was somewhat cyanotic, the respirations labored and rather wheezing. The pulse was 22 to the quarter, of good size; duration fairly good; vessel wall not palpable. Blood pressure, 215 mm.

Heart. Point of maximum impulse neither visible nor palpable. By percussion and auscultation it was localized in the fifth interspace, 12 cm. from the midsternal line. Dulness 5 cm. to the right. Sounds: first, reduplicated at the apex; second, clear. The reduplication was not clearly heard in the tricuspid area. At the base the sounds were clear in both the pulmonic and aortic areas, the aortic second sharply ringing, greatly accentuated. Fine râles were heard at both bases.

The patient was admitted to the hospital on the following day, at which time the apex was found 1 cm. farther out, and a systolic murmur was audible at the apex, transmitted but a short distance outward. The sounds were feeble over the precordium. The second sounds were clear. After rest in bed the patient improved greatly. The fine râles cleared up, and eleven days later the patient was discharged. The apical murmur, however, persisted. The blood pressure in bed was 165 mm. The urine at first showed a trace of albumin, which disappeared later; specific gravity normal.

This was a well-marked case of dilatation, with mitral insufficiency.

CASE IV. *Hypertrophy of the heart; mitral insufficiency.*—A. B. (Hospital No. 31,173), a young woman aged twenty-four years, was admitted to the hospital on July 9, 1900, where she passed through an attack of typhoid fever of forty-six days' duration without serious complications. The urine was at all times free from albumin. As a child she had had measles, mumps, and scarlet fever, the latter followed by nephritis; the radial arteries were not palpable.

Heart. Point of maximum impulse not palpable. Sounds best heard in the fourth space, 9 cm. from the median line. First sound rather feeble. The aortic second louder than the second pulmonic. There was no further note on the heart.

On December 22, 1902, the patient returned for examination. She had been married and had had one child since discharge. Since the birth of the child she had not felt well.

Pulse, slightly irregular in rhythm, 27 to the quarter, occasionally intermittent, of moderate size, and good duration. The vessel wall was not palpable. Blood pressure 170 mm.

Heart. Apex impulse in the fourth space, 10 cm. from the median line. Dulness extended 3 cm. to the right of the median line. The impulse was strong, rather snapping, associated with and apparently preceded by a very slight thrill. "The first sound at the apex is rather sharp, followed by a slight systolic murmur. This murmur is heard in the axilla and faintly in the back; it is a little louder in the tricuspid area. In the pulmonic area there is a loud systolic murmur. The second sound is sharp and clear, relatively accentuated, as compared with the second aortic; no reduplication. In the aortic area there is a well-marked systolic murmur transmitted upward over the manubrium and into the carotids. The second sound is clear."

In this instance the enlargement of the ventricle and the slight irregularity of the pulse, as well as the transmission of the systolic murmur, all tend to suggest that a true mitral insufficiency exists. The snapping character of the first sound and the slight suggestion of a palpable thrill, although no corresponding murmur was to be heard, are in favor of the existence of an actual valvular lesion.

CASE V. *Mitral stenosis and insufficiency (?).*—A. S. (Hospital No. 32,037), a girl aged ten years, was admitted to the hospital on September 3, 1900, where she passed through a typhoid fever of thirty-four days' duration, complicated by cystitis. The case was of moderate severity, the pulse not particularly rapid at any time. As a child she had had measles, tonsillitis, and bronchitis at three years, and again the winter before entry.

In the hospital record it was noted:

"*Heart.* Point of maximum impulse in the fourth space, 6 cm. from the midsternal line. Both sounds well heard at the apex. Loud systolic murmur at the base. At the apex the first is accompanied by a very faint systolic murmur; the second pulmonic, not accentuated."

Later on it was again noted that there was a faint systolic murmur all over the precordium, loudest in the pulmonic area. No note was made on the heart at the time of discharge. The patient was not, however, supposed to have a cardiac lesion.

On December 22, 1902, the patient returned for examination. She had been perfectly well since discharge. The pulse was regular, 25 to the quarter, of moderate size, and rather long duration. The vessel wall was not palpable. Blood pressure 135 mm.

Heart. Apex visible and palpable in the fourth space, 7 cm. from the midsternal line, just inside the mammillary line. Dulness 2.25 cm. to the right of the median line. The impulse was strong, rather prolonged, preceded by a suggestion of a thrill. The first sound at the apex was prolonged and booming. There was a distinct echo in the latter part of diastole, which was almost loud enough to be called a true presystolic murmur, having all the characteristics of a presystolic murmur of slight degree. The first sound was succeeded by a very soft, slight systolic murmur, which was heard in the axilla, but not in the back. Second sound well heard at the apex. In the tricuspid area there was a soft systolic murmur which became louder as one reached the pulmonic area. The second sound in the pulmonic area was sharp and clear. The same murmur was heard at the aortic orifice feebly, but better than in the pulmonic area; also over the manubrium and in the carotids. At the time of the examination it was noted: "It would seem that the apex murmur (presystolic) was doubtless produced at the time of entrance of blood into the ventricle from the left auricle, and, in all probability, at the mitral valve. The case may be one of mitral stenosis, though it is not impossible that the heart may be quite normal."

CASE VI. *Hypertrophy and dilatation of the heart; mitral insufficiency; hyper-tension.*—M. Z. (Hospital No. 17,636), a woman aged forty-three years, was admitted to the hospital on October 19, 1896, where she passed through a typhoid fever of sixty-four days' duration, without complications. The urine showed a trace of albumin, and once a hyaline cast. She had been previously a perfectly healthy woman, excepting for an attack of typhoid fever seven years before and for occasional pains in her joints, unassociated with fever or swelling. She had had twelve children and two miscarriages.

When in the hospital it was noted that at the apex the first sound was replaced by a soft systolic whiff, faintly transmitted to the axilla.

The second sounds were clear. The heart's action was rather irregular. The murmur could be heard all over the base of the heart. The highest recorded pulse in the hospital was 120. No further note was made upon the circulatory apparatus. On discharge the patient was considered to have a normal heart.

The patient returned to the hospital on February 16, 1903, in answer to my letter. For two months she had suffered from shortness of breath, especially on excitement and exertion. This was also worse at night, so that at times she had to sit up in bed. On physical examination the pulse was 26 to the quarter, of fairly good size; duration long; vessel wall not palpable. The blood pressure was 200 mm. The urine was free from albumin.

"*Heart.* Point of maximum impulse palpable in the fifth interspace, 9.50 cm. from the median line. Dulness extends 2.75 cm. to the right of the median line. Sounds: The first at the apex is followed by a well-marked blowing systolic murmur heard faintly throughout the axilla; second clear. In the tricuspid area the murmur is less marked; the second sound clear. In the pulmonic area the first sound is represented by a slight systolic murmur; the second sharp and loud. In the aortic area the first is followed by a very soft systolic murmur heard over the manubrium, not in the carotids. The second pulmonic is sharper than the second aortic. No reduplication of the second sound. In the erect posture the murmur persists at the apex, but is not heard in the back." Two months later the patient returned to the Out-patient Department again, complaining of shortness of breath. At this time the apex had moved outward 2 cm., while in other respects the signs were about the same.

CASE VII. *Hypertrophy; mitral insufficiency.*—B. W. (Hospital No. 24,675), a woman aged twenty-six years, was admitted to the hospital on September 11, 1898, where she passed through a long typhoid fever, with two relapses, complicated with arthritis of the ankles. The urine was free from albumin. The patient had always been healthy and had had previously no serious illnesses. In the hospital the following note was made on the heart:

"*Heart.* Point of maximum impulse, fifth space, 3 cm. inside the mammillary line. At the point of maximum impulse there is a soft, blowing systolic murmur, not traceable into the axilla. Sounds at base clear; of normal relative intensity. Pulse regular; good volume; 36 to the quarter." In several notes there is no mention of palpable radials. Later it was stated that the second pulmonic was accentuated, and that the murmur was traced to the anterior axillary line.

The patient was examined on March 6, 1903, five and a half years later. After leaving the hospital there was another relapse, with left-sided femoral phlebitis. For some time afterward there was œdema of the feet. Otherwise she has been quite well. The pulse was 80, regular, of fairly good size; long duration. Artery just palpable. Blood pressure 210 mm.

"*Heart.* Apex impulse in the fifth space, 10.5 cm. from the median line. Dulness extends 3.5 cm. to the right of the midsternum. At the apex the first sound is followed by a systolic murmur, which is heard all over the cardiac area, though best at the point of maximum impulse; it is transmitted as far as the mid-axilla. In the erect posture it is still heard at the apex, though with much diminished intensity. In the back as the patient sits up, it is a question whether at times a faint suggestion of a murmur may not be heard. The second sounds are both strong; the second pulmonic is distinctly accentuated."

CASE VIII. *Mitral insufficiency; hypertrophy of the heart;*— E. R. (Hospital No. 28,249), a colored woman aged thirty-eight years, was admitted to the hospital on October 24, 1899, where she passed through a mild attack of typhoid fever of seventeen days' duration. The urine contained a trace of albumin, and hyaline and granular casts. As a child she had had measles, mumps, and chickenpox. No other serious illnesses.

In the hospital it was noted that "the point of maximum impulse is in the fifth space, 8.5 cm. from the median line. Impulse punctate, rather heaving; slight suggestion of a thrill running up to the impulse. At the point of maximum impulse the first sound is replaced by a short blow, which is preceded by a very short, indistinct rumbling. This latter is to be heard above and outside the point of maximum impulse. The systolic murmur is heard over the base. The second pulmonic is slightly accentuated and clear. The aortic second sound is clear." No note as to the palpability of the radial arteries. About two weeks before discharge it was noted that there was a systolic murmur at the apex and pulmonic areas, but on discharge it was stated that the heart sounds were clear.

On August 12, 1903, the patient returned in answer to my letter. She had had one child since leaving the hospital. For three months she has felt rather poorly, the catamènia having been profuse and of late rather irregular—possibly menopause. The pulse was regular, excepting for occasional intercurrent beats, 17 to the quarter; of moderate size, long duration. The vessel wall was just palpable on the right side; not on the left. Temporals not sclerotic. Blood pressure 165.

Heart. Point of maximum impulse visible and palpable in the fifth space, 11.5 cm. from the median line, 1 to 2 cm. outside the mammillary line. The dulness extended 3.7 cm. to the right. Impulse, heaving, stronger than usual. " The first sound at the apex is prolonged and followed by a distinct systolic murmur heard throughout the left axilla and faintly in the back. The second sounds are sharp. In the tricuspid area the murmur is not distinctly audible. The second pulmonic is fairly sharp, and is reduplicated with about two beats on inspiration. The second aortic is not as loud as the second pulmonic. The reduplication of the second sound is not heard in the aortic area, and is clearly due to pulmonic delay. In both pulmonic and aortic areas there is a slight suggestion of a systolic murmur, which is not heard in the carotids."

CASE IX. *Hypertrophy and dilatation of the heart; mitral insufficiency.*—J. F. (Hospital No. 36,210), aged eighteen years, was admitted to the hospital on September 9, 1901. He passed through a typhoid fever of very moderate intensity, the probable length of fever being only about thirteen or fourteen days. The urine showed a slight trace of albumin on entrance and a few coarsely granular casts, but both albumin and casts disappeared later. There were no complications. He had had chickenpox when young, but knew of no other serious illnesses. Is a farmer, and exposed to a good deal of bad weather. Does not drink nor use tobacco.

In the hospital the pulse was 21 to the quarter; marked sclerosis of radials. "Heart sounds loud and booming. Systolic murmur in pulmonic area. Second sound clear." No further note was made on the heart. The highest recorded pulse was 112. During convalescence the pulse was as low as 48.

In September, 1903, he reported in answer to my letter, and, in my absence, was examined by Dr. Briggs. He had been perfectly well since leaving the hospital. "Radials much sclerosed. Brachials thickened and visibly pulsating at the elbow. Pulse 24 to the quarter, slightly irregular in force and rhythm, with rare intermissions of rather short duration; large volume; not collapsing. Blood pressure 182."

Heart. Point of maximum impulse in the fourth interspace, 8 cm. from the midsternal line, though the impulse was to be felt as far out as 14 cm. from the median line in the fifth interspace, with which dulness was practically coexistent. Relative dulness extended 5 cm. to the right of the midsternal line. The systolic impulse was forcible; the shock of both sounds well felt; no thrill. At the apex both sounds were well heard, the first booming, and followed by a rather intense, blowing, systolic murmur, transmitted to the axilla, but not to the back. "In a small area upward and inward from the apex in the fourth space the second sound has at the beginning of examination a faintly rumbling echo, not running through diastole; this disappears on resting, reappearing after examination. In the tricuspid area and over the precordial region the systolic is well heard; the second sound is clear. In the pulmonic area the systolic is louder than over the right ventricle; not so loud as at the apex. The second pulmonic is louder than the second aortic and is reduplicated, the accent being on the second part of the reduplication, and the length of the interval being more marked during deep inspiration, though present throughout the respiratory phases. The aortic sound is clear, ringing, bell-like, and, though not so loud, is more intense than the second pulmonic. The first sound is fainter. No systolic murmur audible. There is no diastolic murmur to be heard at the base nor along the border of the sternum."

CASE X. *Four months after discharge, aortic insufficiency which had disappeared five months later.*—J. C. (Hospital No. 39,371), a man aged twenty-two years, entered the hospital on June 26, 1902. Here he passed through a typhoid fever of moderate severity, without complications, leaving the hospital on August 9, 1902. The urine showed a trace of albumin at the height of the disease. He had had measles as a child; denied venereal disease; habits good. In the hospital it was noted that the radial artery was palpable. On two occasions during the disease the blood pressure was 128.

Heart. Dr. McCrae noted that the point of maximum impulse was very feeble, visible (?) in the fifth space, 10.5 cm. from the midsternal line. The first sound was everywhere of rather an indefinite quality, but there was no actual murmur.

On November 30th, about sixteen weeks after discharge from the hospital, he reported in answer to my letter. The pulse was 27 to the quarter (the patient was rather nervous), collapsing, but of clearly high systolic pressure. Vessel wall not palpable. Blood pressure 174 mm.

Heart. Apex in the fourth interspace, 10.5 cm. from the midsternal line. Sounds clear and strong at the apex. A soft systolic murmur was heard at the tricuspid area and at the aortic area transmitted upward over the manubrium. The second aortic sound was very loud; no murmur. Both sounds were heard in the carotids, the first prolonged as a roughened murmur. No murmur was heard in the pulmonic area. The systolic murmur was distinctly loudest at the aortic area, and was transmitted upward. *There was a very soft diastolic murmur, heard along the left sternal border.* This murmur was extremely slight, but was heard by Dr. Briggs, as well as by myself.

Five months later, on April 21st, the patient reported at the dispensary. He had been complaining of a slight cough, the last stage of a cold which he had had for about a week. He was still hoarse, with a teasing cough. Had not been working regularly on account of nervousness. The lungs were clear. The pulse was regular, of good size; nothing remarkable about its quality.

"*Heart.* Apex impulse not seen nor felt. By stethoscope and percussion it was localized 9.5 cm. from the median line, in the fifth space. Dulness extends 3.5 cm. to the right of the median line. At the apex and all over the cardiac area, most marked in the aortic area, there is a soft systolic murmur, which wholly disappears in the erect posture. The sounds are otherwise clear, excepting that in the pulmonic area there is a reduplication of the second sound, which occurs several times during ordinary inspiration, the delayed part being clearly the second pulmonic. This reduplication is heard at times in the aortic area. There is no diastolic murmur either in the erect or recumbent posture."

The case is one of much interest. May it have been an instance of transient dilatation of the aortic ring?

CASE XI. *Aortic insufficiency.*—L. R. (Hospital No. 20,507), a man aged thirty-nine years, was admitted to the hospital on September 4, 1897, and passed through a typhoid fever of fifty days' duration, followed by a relapse, associated with bronchitis and a pemphigoid eruption on the hands. The urine contained no albumin, but an occasional hyaline and granular cast was found. As a child he had had scarlet fever, and almost every fall had had malarial fever. Four years before entry he had had another attack of typhoid fever; four years before, urethritis. The pulse was not remarkably rapid at any time during the course, and the only note with regard to the circulatory apparatus was "heart negative."

On February 15, 1903, the patient reported in answer to my letter, and, in my absence, was examined by Dr. Briggs. The patient had been well since discharge, but had lived a life of hard work and exposure. "Pulse 82; slightly irregular in force and rhythm; distinctly collapsing; vessel wall moderately thickened; marked visible pulsation in brachials and carotids; none in the temporals. Marked capillary pulsation. Systolic blood pressure, 185 mm.

"*Heart.* Point of maximum impulse just visible and palpable in the fourth space, 12 cm. from the median line, in the left mammillary line. Impulse faint; no thrill. The relative dulness begins at the second left interspace and extends to the right sternal margin at the level of the fourth rib. No absolute cardiac dulness. At the apex both sounds are heard; the first rather muffled, followed by a soft systolic puff, carried to the mid-axilla, and faintly heard at the xiphoid.. The second sound is sharp and clear. Just above the nipple, in a small area, there is a short, faint rumble in diastole, ending before the first sound, which is not snapping. Both sounds are heard over the right ventricle, with a systolic murmur, which becomes more marked in the second, third, and fourth left spaces, and is heard at the base, though not over the manubrium, and in the neck. The pulmonic second is louder, accentuated; occasionally a faint reduplication with inspiration. The aortic second is soft, but clear. In the second and third left interspaces close to the sternum there is a very short, faint diastolic murmur following the second sound."

CASE XII. *Marked arterio-sclerosis.* C. Z. (Hospital No. 17,632), a boy aged thirteen years, was admitted to the hospital on October 19, 1896, where he passed through a typhoid fever of seventeen days' duration, without complications, being discharged on November 19, 1896. There was a trace of albumin, with hyaline and granular casts, during the height of the fever. He had suffered from no previous serious infections, and, so far as could be determined, was a boy of good habits. The highest recorded pulse in the hospital was 112. A full note on the heart was made by Dr. McCrae. Pulse 21 to the quarter, soft, and easily compressible; synchronous in radials and femorals.

Heart. Point of maximum impulse in fourth space, 7 cm. from the median line; wavy; no thrill. Area of cardiac dulness not increased. Sounds: A soft, systolic murmur was heard at the apex, not especially carried around to the axilla; best heard over the second and third left spaces. The second sound was very loud at the apex and much accentuated in the second left space. No further note as to the heart.

On January 4, 1903, he returned in response to my letter. Three years ago he had had an attack of tonsillitis, after which his tonsils were removed. Beyond this he had considered himself quite well. The pulse was 25 to the quarter, showing rather marked irregularities in rhythm; of good size and long duration. The vessel wall was much thickened; readily rolled under the finger. The temporals were tortuous, prominent and somewhat thickened. The systolic pressure was 200 mm.

Heart. The apex impulse was visible and palpable in the fifth space just inside the mammillary line, 8.7 cm. from the median line. The dulness extended 3.2 cm. to the right of the midsternal line. Sounds. The first at the apex was prolonged and booming, followed by a very slight systolic murmur, which was lost before one reached the mid-axilla. " A much more distinct, high-pitched, blowing systolic follows the first sound in the tricuspid area and over the right ventricle in the third and fourth spaces. It is, however, barely audible in the pulmonic area, and is not heard in the aortic area or over the manubrium. It is not affected by change of position. Sounds at the base clear. The second aortic is accentuated." At the time that this note was made the following remarks were added: "In this instance there is a distinctly hypertrophied heart, with marked sclerosis of the radials and temporals. The murmur heard in the tricuspid area is not of the ordinary character of a functional murmur, being higher pitched and having a very blowing sound."

This case, it seems to me, is one of particular interest, in view of the fact that beyond the tonsillitis the only element to which one could reasonably ascribe the cardio-vascular abnormalities was the preceding typhoid fever.

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SUMMARY.

A study of the condition of the heart and vessels in 183 individuals who have passed through typhoid fever at the Johns Hopkins

Hospital within the last thirteen years has revealed the following facts:

1. The average systolic blood pressure in these old typhoids was appreciably higher than in control observations upon healthy individuals.
2. The higher average of the blood pressure was constant in every decade.
3. In many instances among the old typhoids the blood pressure exceeded appreciably the limits of what is usually regarded as normal.
4. The radial arteries in the old typhoids were palpable in a proportion nearly three times as great as that found in control observations upon supposedly healthy individuals who had never had the disease.
5. The average size of the heart was greater among the old typhoids than in the same cases at the time of admission to the hospital. The difference held good also when the cases were classed according to age by decades.
6. Cardiac murmurs were heard with considerably greater frequency among the old typhoids and in the same cases during the attacks.
7. In 8 cases where, on discharge from the hospital, the heart was considered normal, subsequent examination revealed hypertrophy, with mitral insufficiency. One case showed a possible mitral stenosis; one an aortic insufficiency; one a striking general arteriosclerosis, with hyper-tension.
8. In one case an aortic diastolic murmur was present four months after discharge, but had disappeared five months later.
9. Those patients whose pulse during the disease was remarkably rapid or irregular, showed, in general, on later examination, a blood pressure above the common average for the old typhoids. In other respects, however, their condition differed but little from the general run of cases.
10. Those cases in which a systolic murmur at the apex of the heart was observed during the attack showed later an increase in the blood pressure and in the size of the heart, as compared both with the mean of the observations made upon the same cases on admission to the hospital and with the general average for the old typhoids. Nearly one quarter of those cases in which during the attack, systolic apical murmurs were detected, showed, on later examination, evidences of organic heart disease. Indeed, the majority of all the cases of organic cardiac lesions among the 183 old typhoids came from this small group of 31 cases.

It is recognized that these results are based upon the analysis of a number of cases too small to justify final conclusions; the next 200 cases may considerably modify the figures. Yet the fact that these 183 old typhoids are materially older, from a point of view of their hearts and arteries, than the average individual who has not had typhoid fever, would tend to support the views of those who regard this disease as an active element in the ætiology of a considerable number of cases of cardiac hypertrophy and dilatation coming on sometimes in early life, as well as an important factor in the production of those vascular changes which Cazalis has happily called "*la rouille de la vie.*"

MULTIPLE SARCOMA.[1]

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This subject is one so broad that it becomes of interest alike to the internist, the surgeon, and the dermatologist.

The particular class of cases which I propose to consider is that in which there are multiple sarcomatous growths in the skin and subcutaneous tissue, excluding that class of tumors characterized by lymphoid cells, in which are included leukæmia, pseudoleukæmia, and malignant lymphoma, and also the so-called sarcoid group, comprising idiopathic hemorrhagic sarcoma, sarcoma cutis, and multiple benign sarcoid. Cases have been reported in which the tumors seemed to have been multiple from the beginning, but it seems more probable that there was a primary growth which may have escaped notice, so rapidly was it followed by an outburst of metastatic tumors. The secondary growths may be pigmented or non-pigmented, or may be mixed—*i. e.*, some may show melanotic material, while others are entirely white, which was observed in one of my cases to be reported later. They may belong to the round, spindle, or myeloid form of sarcoma, or the cells may change from one form to another during the progress of the disease. The tumors usually appear as small, round nodules, the size of a shot, which rapidly develop into oval or round plates, which may be somewhat depressed in the centre. The size to which they may grow is indefinite; as a rule, however, few reach a greater diameter than one inch. They are situated either in the skin proper, or in the deep fascia, hence may move with the skin or the skin may move freely over them. Ulceration may occur either from pressure or from apparently spontaneous breaking down of the new tissue. They may or may not be encapsulated. The latter condition is said to improve the outlook. The appearance of the cutaneous or subcutaneous nodules is either preceded or rapidly followed by involvement more or less

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[1] Read before the Medical Society of Washington, D. C., October 7, 1903.